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**VOLUME I - GENERAL FACTORS**

**EXPOSURE FACTORS HANDBOOK**

Update to Exposure Factors Handbook  
EPA/600/8-89/043 - May 1989

Office of Research and Development  
National Center for Environmental Assessment  
U.S. Environmental Protection Agency  
Washington, DC 20460

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**VOLUME II - FOOD INGESTION FACTORS**

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**VOLUME III - ACTIVITY FACTORS**

**EXPOSURE FACTORS HANDBOOK**

Update to Exposure Factors Handbook  
EPA/600/8-89/043 - May 1989

Office of Research and Development  
National Center for Environmental Assessment  
U.S. Environmental Protection Agency  
Washington, DC 20460

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## PREFACE

The National Center for Environmental Assessment (NCEA) of EPA's Office of Research and Development (ORD) has prepared this handbook to address factors commonly used in exposure assessments. This handbook was first published in 1989 in response to requests from many EPA Program and Regional offices for additional guidance on how to select values for exposure factors.

Several events sparked the efforts to revise the Exposure Factors Handbook. First, since its publication in 1989, new data have become available. Second, the Risk Assessment Council issued a memorandum titled, "Guidance on Risk Characterization for Risk Managers and Risk Assessors," dated February 26, 1992, which emphasized the use of multiple descriptors of risk (i.e., measures of central tendency such as average or mean, or high end), and characterization of individual risk, population risk, important subpopulations. A new document was issued titled "Guidance for Risk Characterization," dated February 1995. This document is an update of the guidance issued with the 1992 policy. Third, EPA published the revised Guidelines for Exposure Assessment in 1992.

As part of the efforts to revise the handbook, the EPA Risk Assessment Forum sponsored a two-day peer involvement workshop which was conducted during the summer of 1993. The workshop was attended by 57 scientists from academia, consulting firms, private industry, the States, and other Federal agencies. The purpose of the workshop was to identify new data sources, to discuss adequacy of the data and the feasibility of developing statistical distributions and to establish priorities.

As a result of the peer involvement workshop, three new chapters were added to the handbook. These chapters are: Consumer Product Use, Residential Building Characteristics, and Intake of Grains. This document also provides a summary of the available data on consumption of drinking water; consumption of fruits, vegetables, beef, dairy products, grain products, and fish; breast milk intake; soil ingestion; inhalation rates; skin surface area; soil adherence; lifetime; activity patterns; and body weight.

A new draft handbook that incorporated comments from the 1993 workshop was published for peer review in June 1995. A peer review workshop was held in July 1995 to discuss comments on the draft handbook. A new draft of the handbook that addressed comments from the 1995 peer review workshop was submitted to the Science Advisory Board (SAB) for review in August 1996. An SAB workshop meeting was held December 19-20, 1996, to discuss the comments of the SAB reviewers. Comments from the SAB review have been incorporated into the current handbook.



## FOREWORD

The National Center for Environmental Assessment (NCEA) of EPA's Office of Research and Development (ORD) has five main functions: (1) providing risk assessment research, methods, and guidelines; (2) performing health and ecological assessments; (3) developing, maintaining, and transferring risk assessment information and training; (4) helping ORD set research priorities; and (5) developing and maintaining resource support systems for NCEA. The activities under each of these functions are supported by and respond to the needs of the various program offices. In relation to the first function, NCEA sponsors projects aimed at developing or refining techniques used in exposure assessments.

This handbook was first published in 1989 to provide statistical data on the various factors used in assessing exposure. This revised version of the handbook provides the up-to-date data on these exposure factors. The recommended values are based solely on our interpretations of the available data. In many situations different values may be appropriate to use in consideration of policy, precedent or other factors.

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